

Advanced Wireless Communication for Reliable Controlled Systems

Faculty of Engineering and Design, Kagawa University, A.Prof. Koji Ishii

ishii.koji@kagawa-u.ac.jp



(1) Motivation and Contribution of this Study

The aim of our study is to enhance the reliability and robustness of the wireless networked controlled systems. To meet the society 5.0, the cyber and physical spaces should be seamlessly connected by the network as depicted in Fig.1. However, most of the studies in communication systems focus on how to improve AVERAGE or MAXIMUM throughput performances, that is, do not consider the quality of services (control). Most of the studies in control system focus the stability of control not considering the feature of wireless communication such as communication error, communication delay and so on. This work challenges to integratedly design wireless communication protocol and control law.



Fig. 1 Networked Controlled Systems

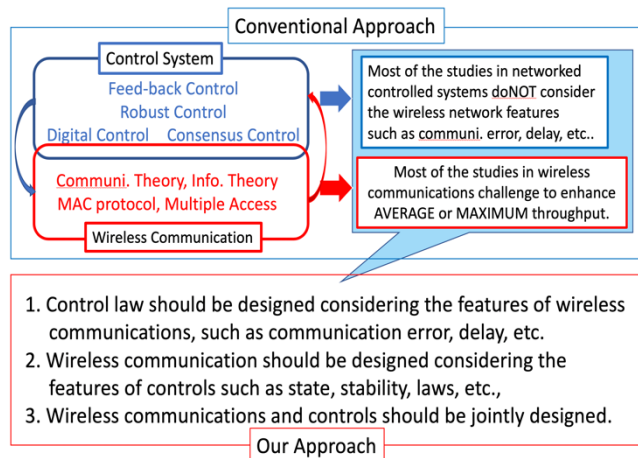


Fig. 2 Approach of this study

(2) IEEE 802.15.4 based Networked Controlled Multi-Plants System

For realizing factory automation where multiple-plants are controlled over the air by a single controller, IEEE 802.15.4 has been proposed, whose superframe consists of CSMA/CA based period (called as CAP) and TDMA based period (called as CFP) as depicted in Fig.3. The controller should consider

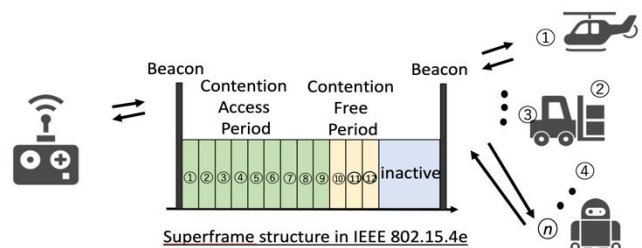


Fig. 3 Structure of Superframe

efficient scheduling for the given superframe since the time resource (slots) is less than the number of controlled plants. Our research tries to design the scheduling as well as control inputs for multiple-plants considering communication error and communication delay based on model predictive control.

(3) Cooperative Communication for Network Controlled Multiple-Plants System

As an advance wireless communication, cooperative communication techniques i.e., multihop communication, cooperative diversity, have been studied. This work applies such sophisticated communication techniques to networked controlled system.

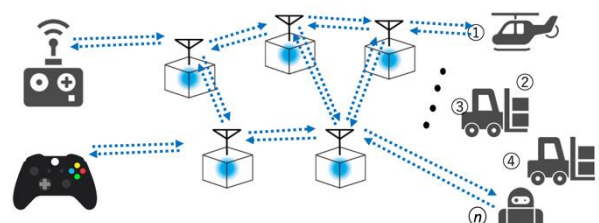


Fig. 4 Cooperative Communication based NCS